

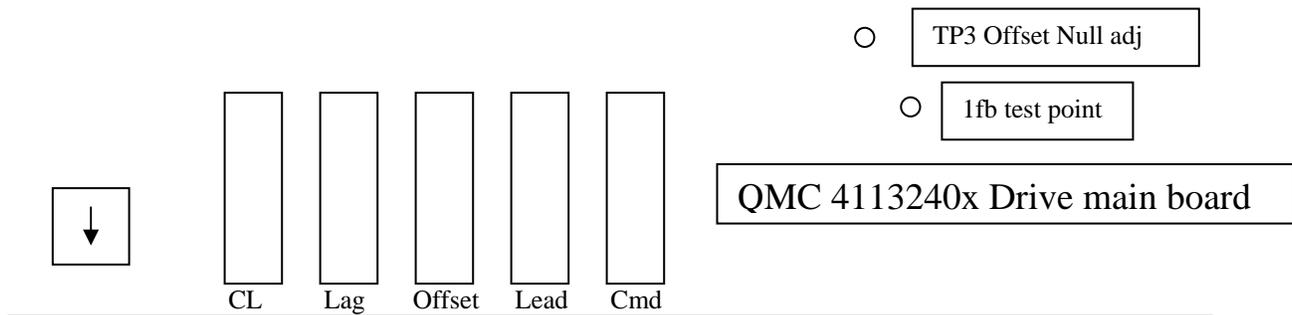
Troubleshooting UIC Chain Driver Systems

The chain drive system consists of three major components. The chain driver control card, the QMC switching servo amplifier and the brushless drive motor. The chain driver control card is the heart of the closed loop control system and contains a microcontroller, input, output and status LEDs. This card receives commands from the machine controller and generates the drive signal for the switching servo amplifier. The chain driver control card's inputs include limit switches, encoder positioning and home pulses. When the system is operating normally, LT4 will be the only status LED, which is illuminated. When a failure condition exists, the microcontroller may illuminate status LEDs that will aid in troubleshooting, see page 3.

The QMC amplifier also has four fault lamps. They are OV (over voltage), UV (under voltage), CF (Commutation fault/over temp) and SF. If any of these indicators come on or fail to extinguish after power up, the drive and/or brushless servomotor are most likely defective. The over voltage and under voltage indicators generally indicate if the high voltage dc supply is within the correct operating range. However, a faulty drive can cause one of these indicators to illuminate.

When a chain fault occurs (message from diagnostics or lamp), the cause is typically caused by the chain having a time-out limit. In other words, the chain did not advance to the proper position in the time allotted. This type of failure is common and typically is caused by one of the following problems:

- Power dip (brown out)
 - Mechanical bind in chain.
 - Loose drive belts, chains, sprockets or pulleys.
 - Switching servo amplifier failure.
 - Switching servo motor failure.
 - Chain driver card failure.
 - Encoder failure.
1. The best troubleshooting method for this system is to first eliminate the obvious. Palm down and power down the machine. Unplug the drive motor connections and attempt to rotate the motor by hand. If the motor, drive or chain is binding, make necessary repairs.
 2. Verify the AC power is stable, use a line conditioner or UPS to stabilize the power or use a line monitor.
 3. Try swapping the chain driver card. Generally this can be done first because it is easiest.
 4. Look for loose drive belts, chains, sprockets, pulleys or other linkages.
 5. Eliminate the suspect sequencer drive by replacing it with a known good drive. If the trouble does not end after swapping the drive, it is best to re-install the original drive. Try replacing the motor with a known good motor. Again, reinstall the original motor if the problem remains.
 6. Replace any encoder with new. Generally encoder will result in positioning errors.



Initial Setup

| | |
|------------------------|---|
| Set Switch to position | 0 |
| CL | Full CW |
| Lag | Full CCW, 5..6 x CW (adjust CW to stop oscillation) |
| Offset | Adjust for zero drift |
| Lead | Full CW |
| Cmd | Full CCW, 2 x CW |

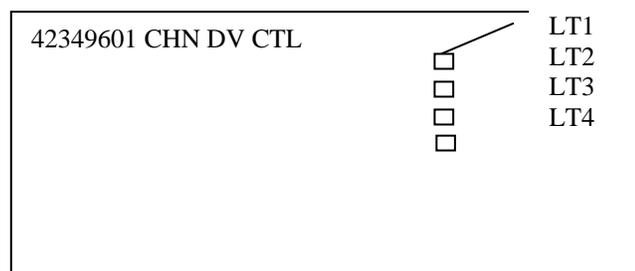
!!! DO NOT ADJUST ANY ROUND POTENTIOMETERS ON THE BOARD !!!

After power up

- Adjust Lag CW 1/4 turns (see above) until all oscillation has stopped. Max turns from full CCW is about 7.
- Adjust CMD pot for optimal axis functioning, specification is a dependent on axis. This ranges from 60 to 100 mS at 1fb test point
- Adjust Offset so the axis has no drift when "in position", TP3 (Vc) voltage near zero.
- Adjust Current Limit CCW after machine is functioning properly -adjust n x 1/4 CCW until machine axis fails - then 1/4 CW to recover. Some versions have no CL pot.
- No adjustment to Lead at this time, Some versions have no lead POT.

Chain Driver Control Assemblies

The chain driver control assembly receives commands from the MIB bus and generates velocity command signals, which drive the QMC switching servo amplifiers. The card also has the rotary encoder input counters, which determine the chain positions. If the machine is stopping due to a chain drive failure, inspection of the chain driver control LEDs may help determine the failure cause. Use the following tables to decipher chain driver card fault/status lights. Note that the 42349603 microcontroller in table two has additional fault status conditions.



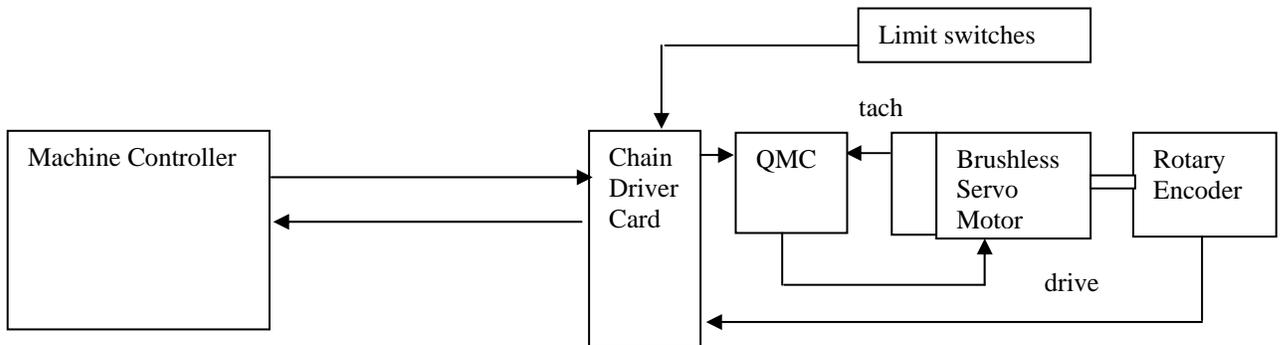
| LT1 | LT2 | LT3 | LT4 | Definition/Error condition |
|-----|-----|-----|-----|--|
| ON | OFF | OFF | OFF | Stop Command (Status only-No Error) |
| OFF | ON | OFF | OFF | Back Up Error Bad communication between chain driver processor and machine controller executive program. Suspect chain obstruction, QMC servo adjustment or failure, Chain driver, executive program, machine controller or wiring. |
| ON | ON | OFF | OFF | Lower limit switch adjustment needed (11ALS) Lower switch adjustment, QMC Servo amplifier adjustment or encoder, belt or coupling problem. |
| OFF | OFF | ON | OFF | Upper limit switch adjustment needed (12ALS) Upper switch adjustment, QMC servo amplifier adjustment or encoder, belt or coupling problem. |
| ON | ON | ON | OFF | Time Out (Chain Fault) event/watchdog timer expired before chain reached position. Suspect: Chain obstructed, chain encoder, belt or coupling, QMC amplifier adjustment or failure, wiring, chain driver card failure, executive or machine controller. Note: A chain fault will typically deactivate the machine program in older machines. |
| OFF | OFF | OFF | ON | Moving Stop (Chain Fault) Emergency stop command issued while chain is moving by E-stop, limit switch or Interlock breach. Investigate E-stop circuits and wiring. |

| LT1 | LT2 | LT3 | LT4 | Definition/Error condition |
|-----|-----|-----|-----|--|
| ON | OFF | OFF | ON | Head Counter Error or VCD Chain Counter Error. Encoder, belt or coupling on VCD Chain. |
| ON | OFF | ON | OFF | Head Mode Error. VCD Chain Mode Error. Chain Driver Card or wiring. |
| ON | OFF | ON | ON | Head Out of Sequence by more than 64 counts. Adjust lag on VCD Chain Amplifier. Encoder, belt or coupling on VCD Chain. QMC Rotary Switch position 0=VCD amp. |
| ON | ON | OFF | OFF | Sequencer Chain Counter Error. Encoder, belt or coupling on sequencer chain. |
| ON | ON | OFF | ON | Sequencer Chain Mode Error Chain driver card or wiring |
| ON | ON | ON | OFF | Sequencer Out of sequence by more than 64 counts Adjust lag on SEQ Chain Amplifier Encoder, belt or coupling on SEQ Chain QMC Rotary Switch position 1=SEQ |

The term mode refers to a chain motion in one of the following conditions:

- In position or holding position,
- Accelerating motion- preparing to slew
- Slew or maximum velocity
- Decelerating motion - moving into position.

Chain Driver Block Diagram



The heart of the chain driver system is the chain driver card. This card accepts commands from the machine controller, generates velocity commands for the QMC amplifier, and has quadrature detection for the rotary encoder and limit switch inputs.

The QMC Switching Servo Amplifier is a brushless servo motor drive. The drive provides three motor drive signals (plus ground), the motor has a tachometer feedback as well as three phase pulse feedback to the QMC drive. The drive's input is a velocity command from the chain driver card. A control relay connects and disconnects the motor from the drive as part of the E-stop circuit.

Typical control sequence

The chain driver receives a command from the machine controller to index. The chain driver issues a velocity command (DC voltage) to the input of the QMC drive (Drive). The drive outputs drive signals to the motor, the motor turns. The turning motor causes the belt, coupling and encoder to turn. The encoder outputs pulses (differential A and B) to the chain driver card. The chain driver card receives the encoder pulses and counts the relative change in position of the chain by using a quadrature detection of the rising and falling edges of both the A and B encoder channels. The chain continues to run until the chain index position is near based on the counted encoder pulses. The chain driver ramps down the velocity signal to slow down and stop the chain from indexing. If the complete cycle occurs within the correct time frame, the process repeats. If the process does not occur, or if the chain driver does not receive the encoder pulses, the chain driver will assert a chain fault. A chain fault indication is then output to the on-board LEDs on the chain driver card as well as a register bit is set so the machine controller executive program can read the status and recognize the fault. Limit switches detect and cause the chain driver card to stop the process and again causing a status indication on the card LEDs and register.